

W9DXCC

DX UNIVERSITY and NIDXA PERESENT

DX'ing FROM the BLACK HOLE 2

SESSION FOUR

DIGITAL DX'ing



DX'ing from the Black Hole



Amateur Radio Digital Modes

There are many digital modes being used currently on the Ham bands. As digital modes relate to DX'ing, the most popular by far are RTTY followed by PSK31.

Because of time considerations my presentation will concentrate on these two digital modes.

Amateur radio has used RTTY for many years but it really took off after WWII. Clinton Desoto mentions systems in 200 Meters and Down (1936).

In the early 1980's new modes began to emerge into today what WB8IMY has described in his 2001 article in QST as "The HF Digital Tower of Babel".



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Amateur Radio Digital Modes

In general digital systems will use an FSK (Frequency Shift Keying) or PSK (Phase Shift Keying) modulation techniques to produce a signal which is then applied to a transmission channel. FSK signals are referred to as AFSK if they are applied to the audio input of an SSB transmitter.

FSK signals are produced by converting the digital data (1's and 0's) into tones that represent the digital levels. FSK systems often occupy more bandwidth than PSK signals and typically do not have as good noise performance (white noise). (Differences on HF are small)

PSK signals are produced by changing the phase of a carrier thus making the phase of the signal represent the 1's and 0's (or change in phase). Typically more complex than FSK systems but are finding use using computer technology.



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PSK

This is a very narrow band keyboard to keyboard mode specifically designed for spectrum conservation as well lower power operations. PSK has a 3 db advantage over FSK however you still have to turn the transmitter on....

There are several soundcard programs available.

I normally use MMVARI but play with others. MMVARI is freeware and fairly well supported.

PSK31

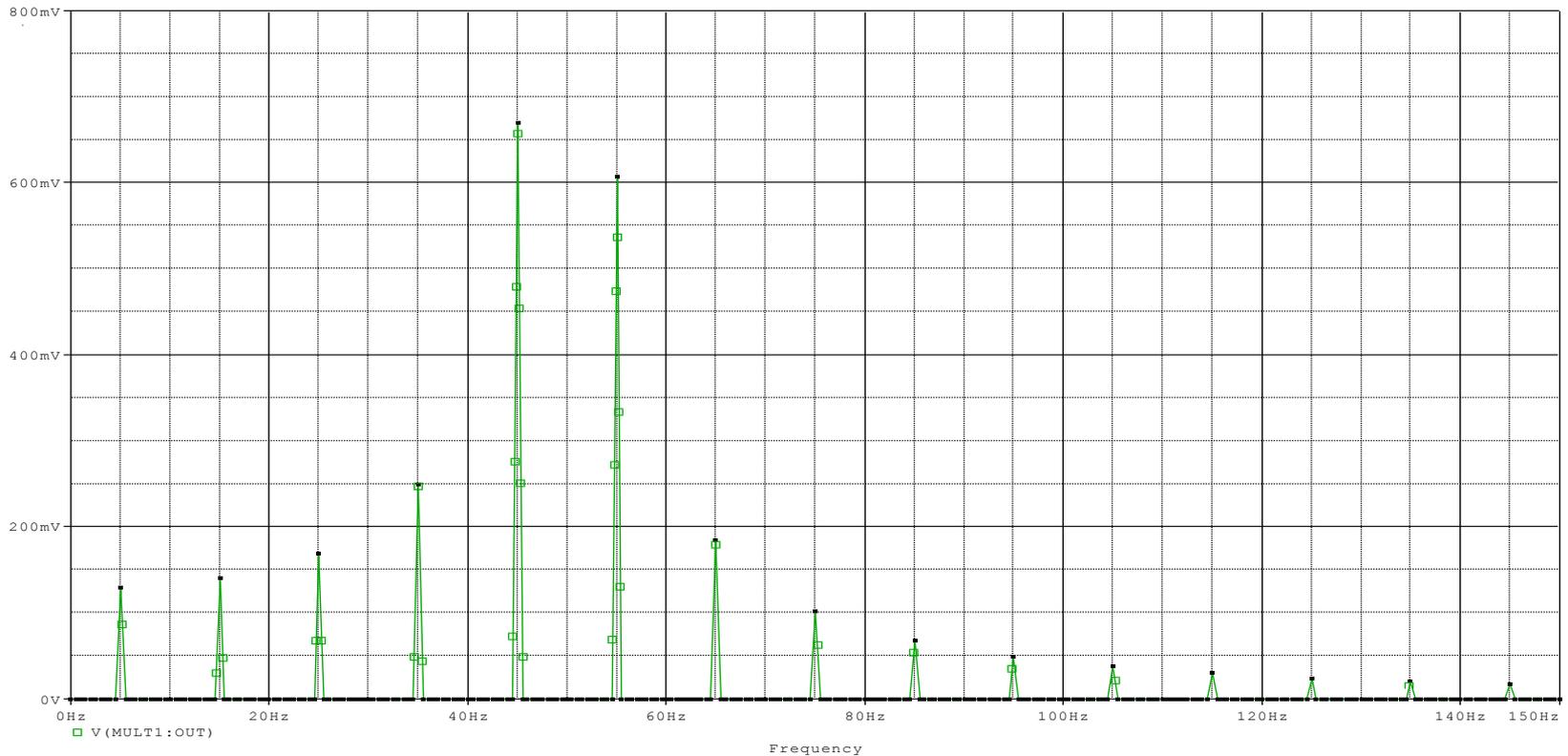
- 1) Very narrow signal less than 100hz
- 2) Easier on transmitter than rtty
- 3) Fairly fast sync
- 4) Can operate in wide rcvr BW



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Frequency Spectrum of PSK signal



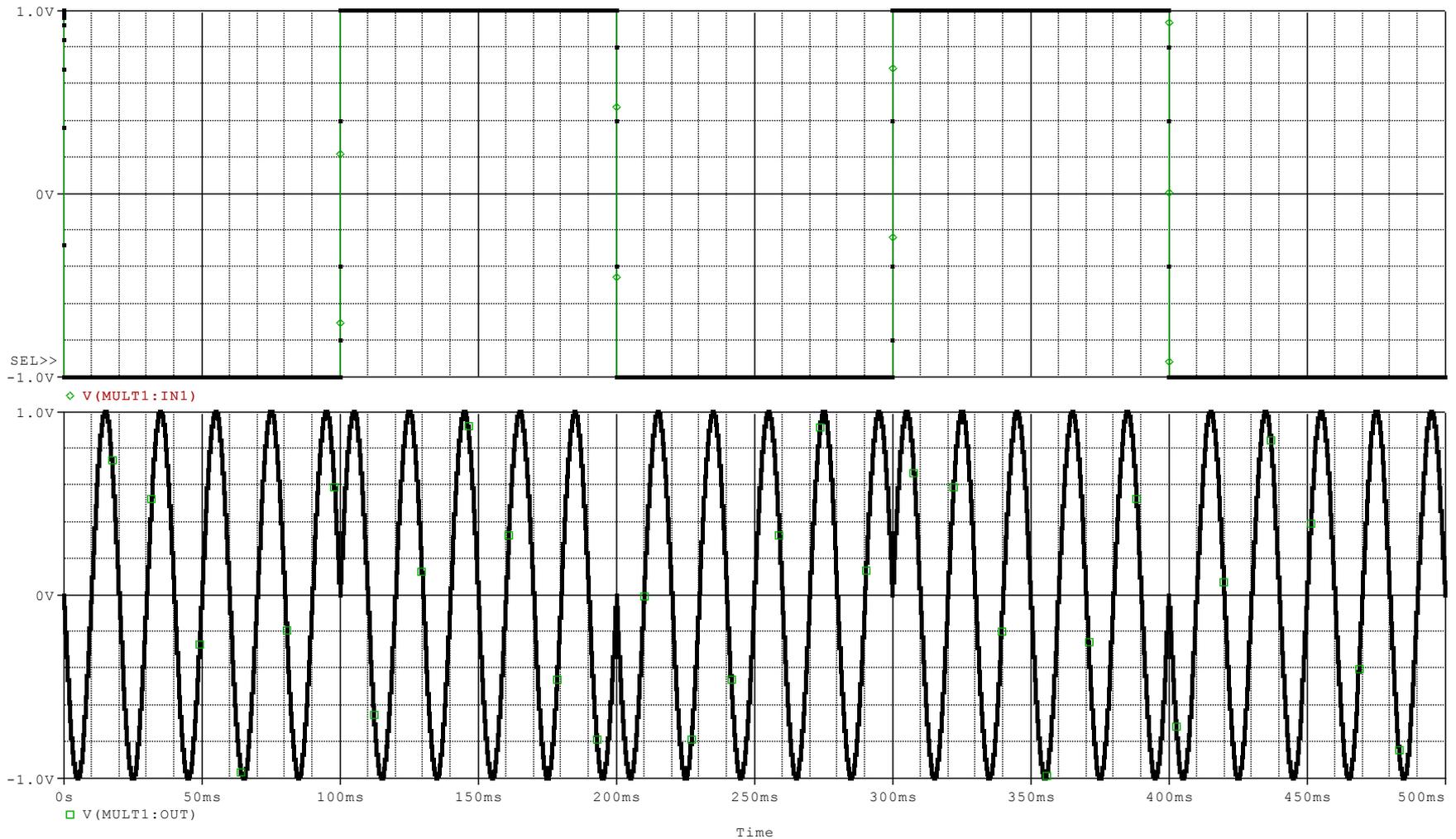
. Note two major tones with sidebands.



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Example of PSK Modulation



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RTTY -- AFSK & FSK

Two methods of transmission:

- AFSK (Audio Frequency Shift Keying)

Inputs audio tones to SSB transmitter via:

Mic input, or auxiliary audio input. e.g., Line In

- FSK (Frequency Shift Keying)

keys the transmitter just like CW

Note: Receiving is the same in either



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AFSK vs. FSK

FSK

- Direct (*like CW keying*)
- “Modern” radios
- RTTY (narrow) filtering
- Dial = Mark frequency
- PTT
- COM FSK keying cable
- *No audio level adjust*
- *Less pitfalls*

AFSK

- Indirect (*tones Mic input*)
- Any SSB radio (*esp. legacy*)
- SSB (wide) filtering
- Dial = sup. car. frequency
- VOX
- Audio cable (*same as PSK31*)
- No com port needed
- *NET (automatic TX tone control)*
- *Easier hook-up*

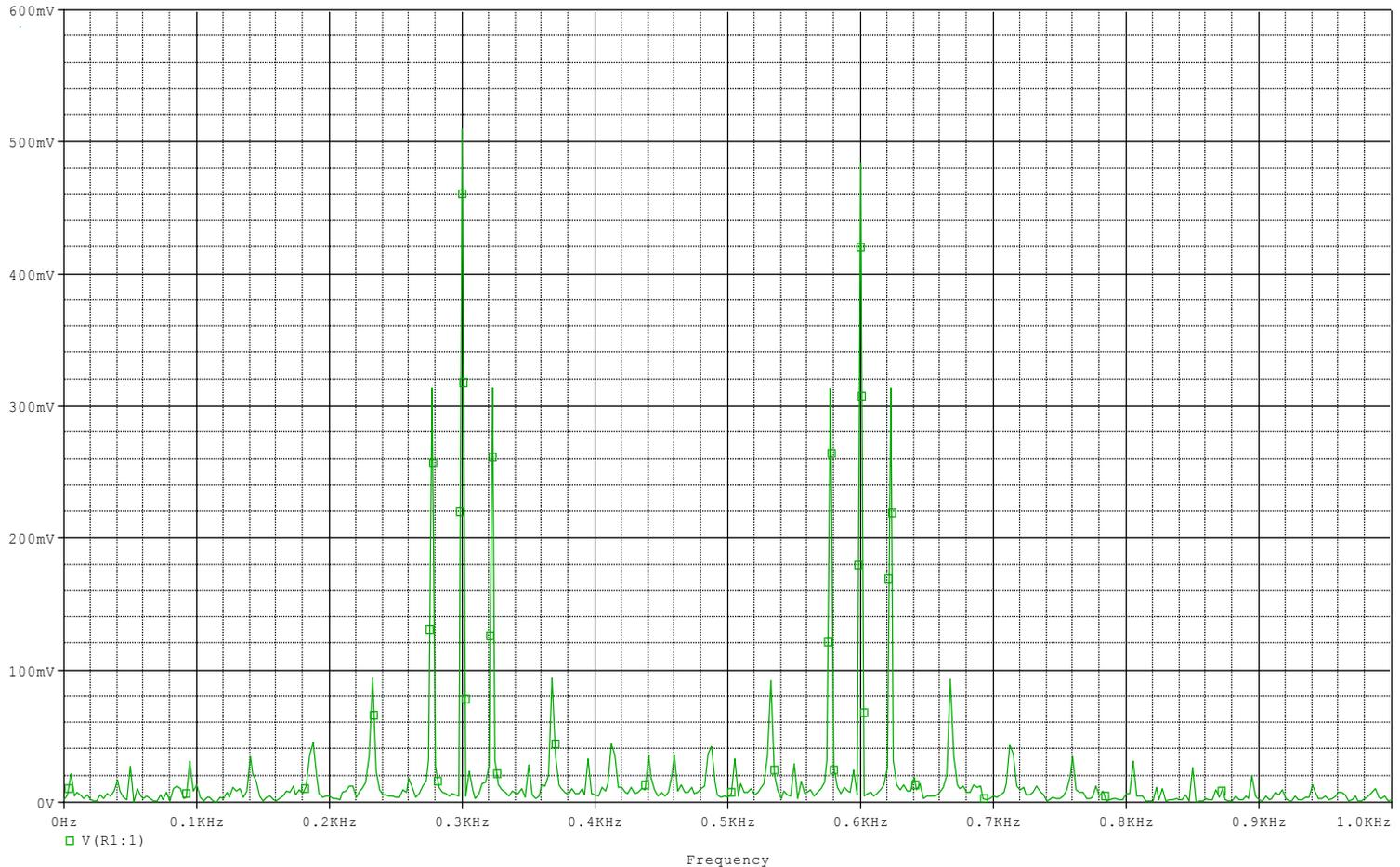


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Frequency Spectrum of FSK Signal

Note two tones with sideband clusters (170 Hz shift)

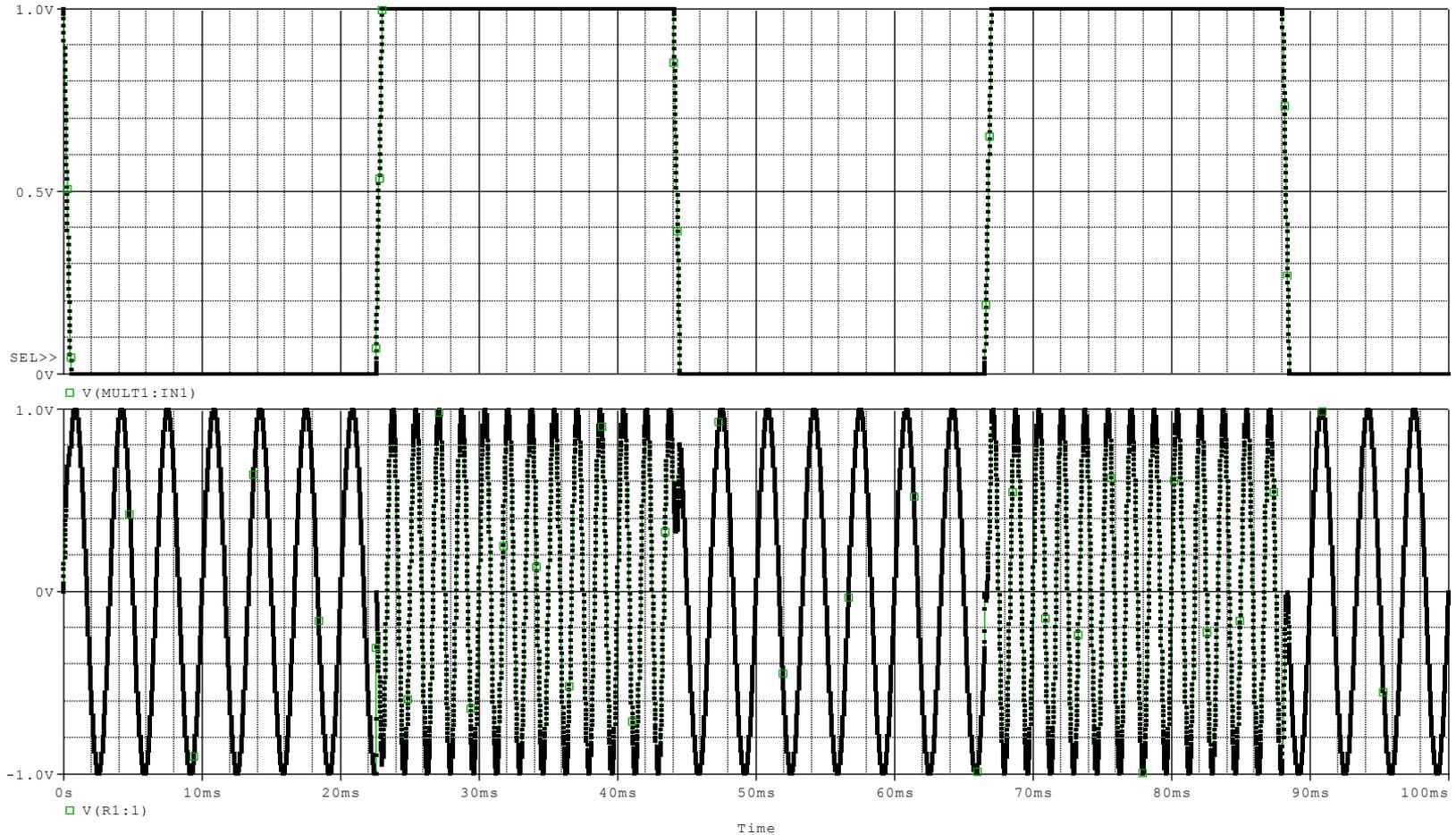


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Typical FSK Signal

Note two tones in lower trace



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Your Dial Frequency vs. Cluster Spot

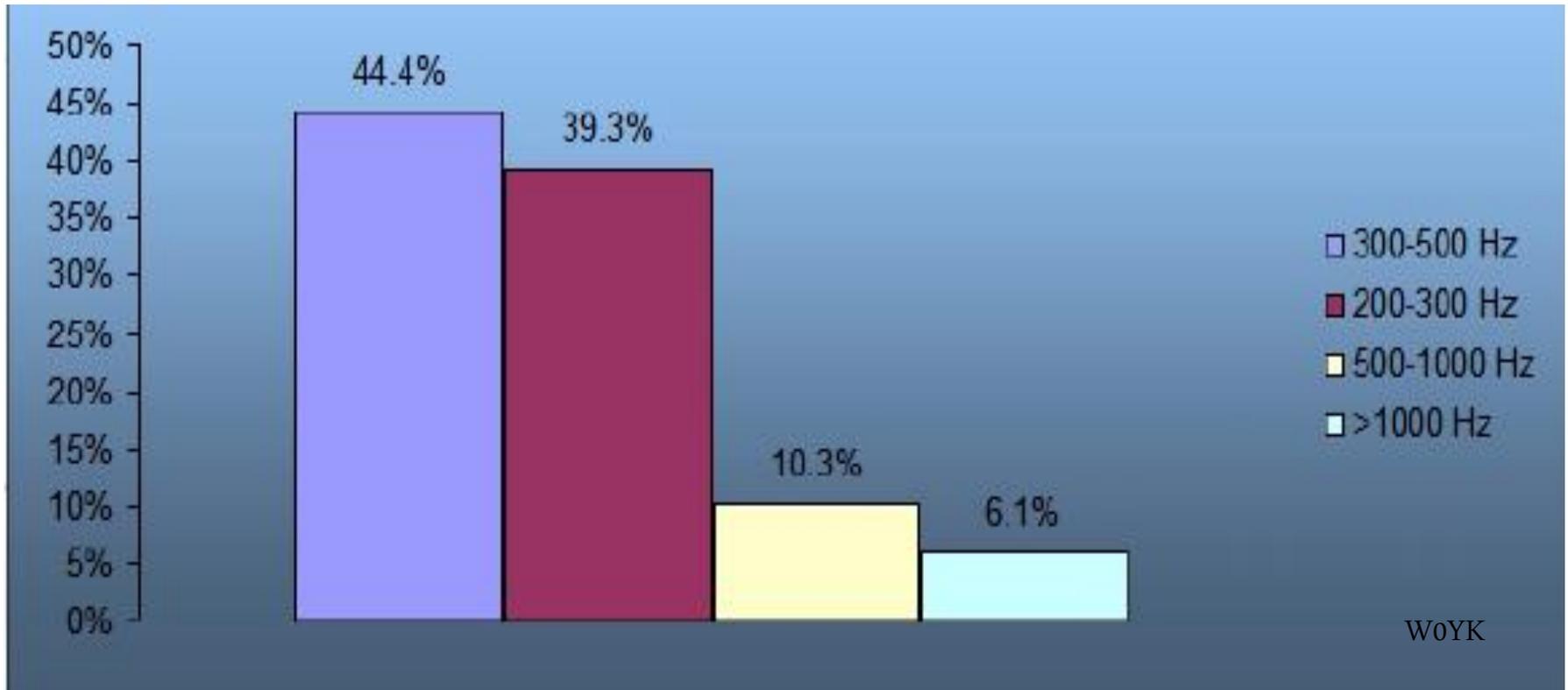
- RTTY RF is independent of local audio tones and whether LSB or USB is used:
 - The higher RF frequency is the Mark (*14090.000 kHz*)
 - The lower RF frequency is the Space (*14089.830 kHz*)
 - The difference between the two is the shift (*170 Hz*)
- FSK displays Mark (*14090.000 kHz*)
- AFSK displays suppressed carrier which varies with local audio tones and sideband used!
 - For Mark tone of 2125 Hz (Space tone of 2295 Hz):
 - LSB (*14092.125 kHz*)
 - USB – Mark & Space tones reversed (*14087.005 kHz*)



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2010 IF Bandwidth Survey



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Digital Software

- Many free or inexpensive programs available, downloadable on the Internet.
- Most popular (and free) is MMTTY for RTTY and MMVARI for PSK.

Others include:

- Digipan (PSK31 & PSK63) -- Free
- MixW (all modes) ≈ \$50.00



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Screen Shots

K9NU (K9NU.MDT) - MMVARI beta ver 0.45

File Edit View Options RadioCommand Help

TX(F12) BPF Carrier(Hz) RX 1686 AFC FFT SYNC 500 1000 1500 2000 2500
TXOFF TX 1684 NET W.F. Sync
Speed Timing(ppm) 500 1K
BPSK 31.25 0 ATC 2K 3K

QSO Data Find Clear Call F5BWS Name Bernard His 599 My 7.028

[RX 2013/9/11 12:15:26]
K9NU Paul de F5BWS
Tnx for infos and QSO BPSK-31 on 15m
Answer 100% QSL via Bureau --- NO E-QSL-Sorry.
Infos : <http://qrzcq.com/call/f5bws>

F5BWS DE K9NU KK
F5BWS DE K9NU
TNX FOR THE QSO Bernard
BEST 73 AND DX
F5BWS DE K9NU SK

Clear	CQ	CQ2	1x1	NU X 3	Brag1	BTU	73	POA	UP	M11	M12
CWID	TU SK	M15	0x2 - 2x4	TU 599	Short	M19	M20	POA RPT	M22	M23	M24
M25	M26	M27	M28	M29	M30	M31	M32	M33	M34	M35	M36

Page1 S/N=24dB 11025.00Hz COM11 ANSI RX FREQ(Left click). open the popup menu(Right click)

MMVARI – PSK31

K9NU (K9NU.MDT) - MMTTY Ver1.68A

File(E) Edit(E) View(V) Option(O) Profiles(S) Program(P) Help(H)

Control Demodulator (IIR) Macro

FIG Mark 2125 Hz Type Rev. HAM NU x3 QANS SK UP
UOS Shift 170 Hz SQ Not. BPF 599TU 73 NAQP M14
TX BW 60 Hz DE3 CQ WW M11 SHORT
TXOFF AV. 70 Hz ATC NET AFC UR 599 Brag1 Brag2 CQ1

QSO Data Init Call DL5ZB Find Name KIRT My His 599 14

```
CQDX CQDX DE DL5ZB DL5ZB DL5ZB CQ
CQ CQ DE DL5ZB DL5ZB DL5ZB CQXWKYU
WZAVXMPOSVBYX7 (; .7YVMXKKY/1?!;
Q/./;
K9NU K9NU K9NU
MCQYVQ K9NU DE DL5ZB
TNX FOR CALL UR 599 599
MY NAME IS KIRT KIRT QTH DORFHAIN DORFHAIN
LOC. JO6ØSW JO6ØSW ..BTU K9NU DE DL5ZB
VQFGP
```

Clear 1X1 DEAR ANS BTU Edit Char. wait

```
FB %n UR %r
NAME IS PAUL
QTH IS ILLINOIS
```

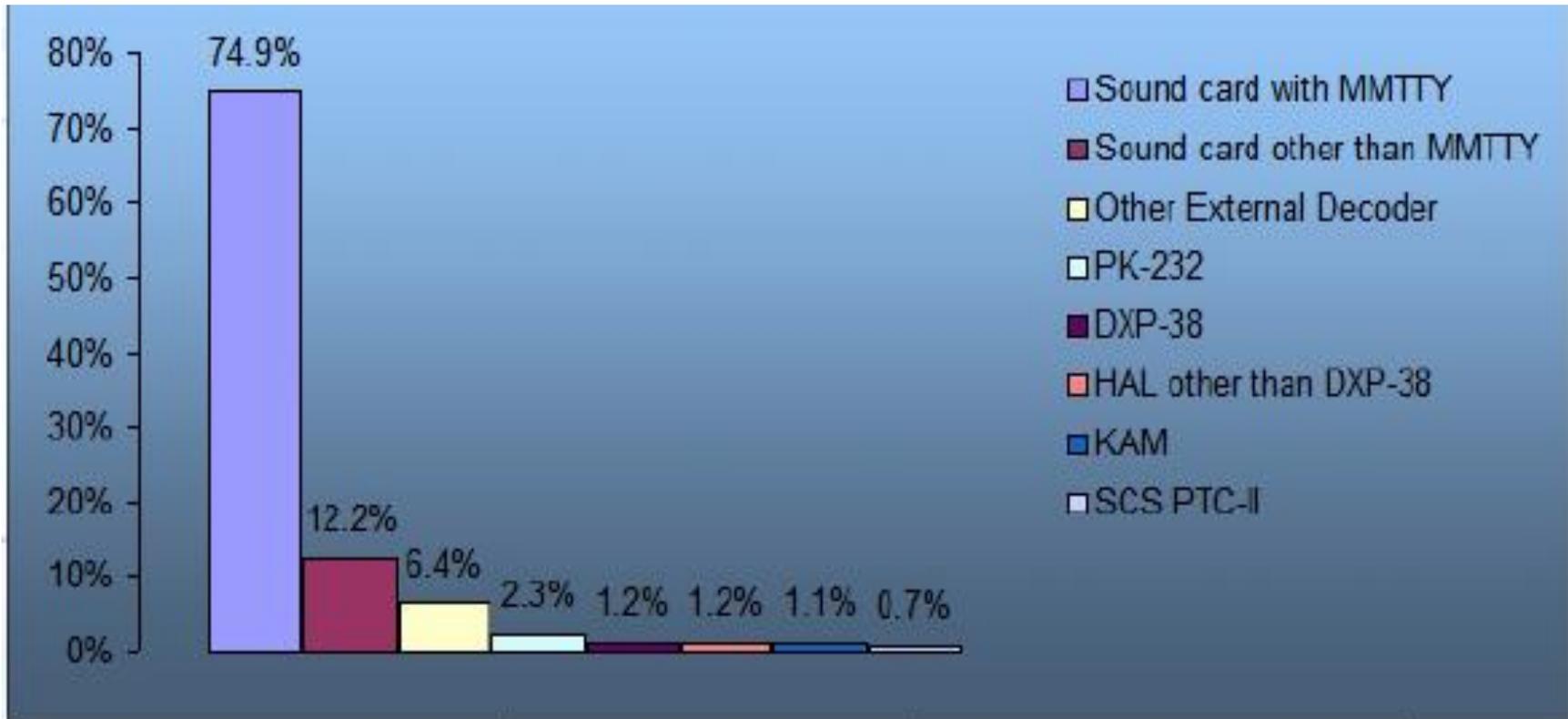
MMTTY - FSK



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Survey – Most Popular Approaches



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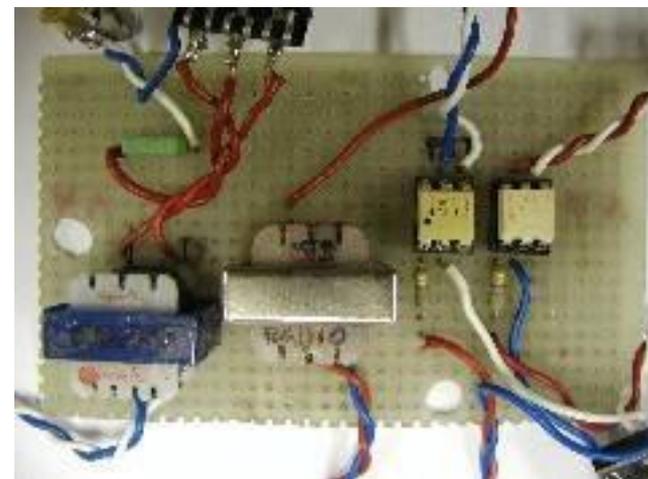
RX/TX Interfaces – Expensive or Simple



Elecraft K3 & KX3

TS-990S/D

Dual TFT Display & Dual Receiver
HF 1.50 MHz Transceiver



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RX/TX Interfaces

Modem

Decoder/Encoder terminology

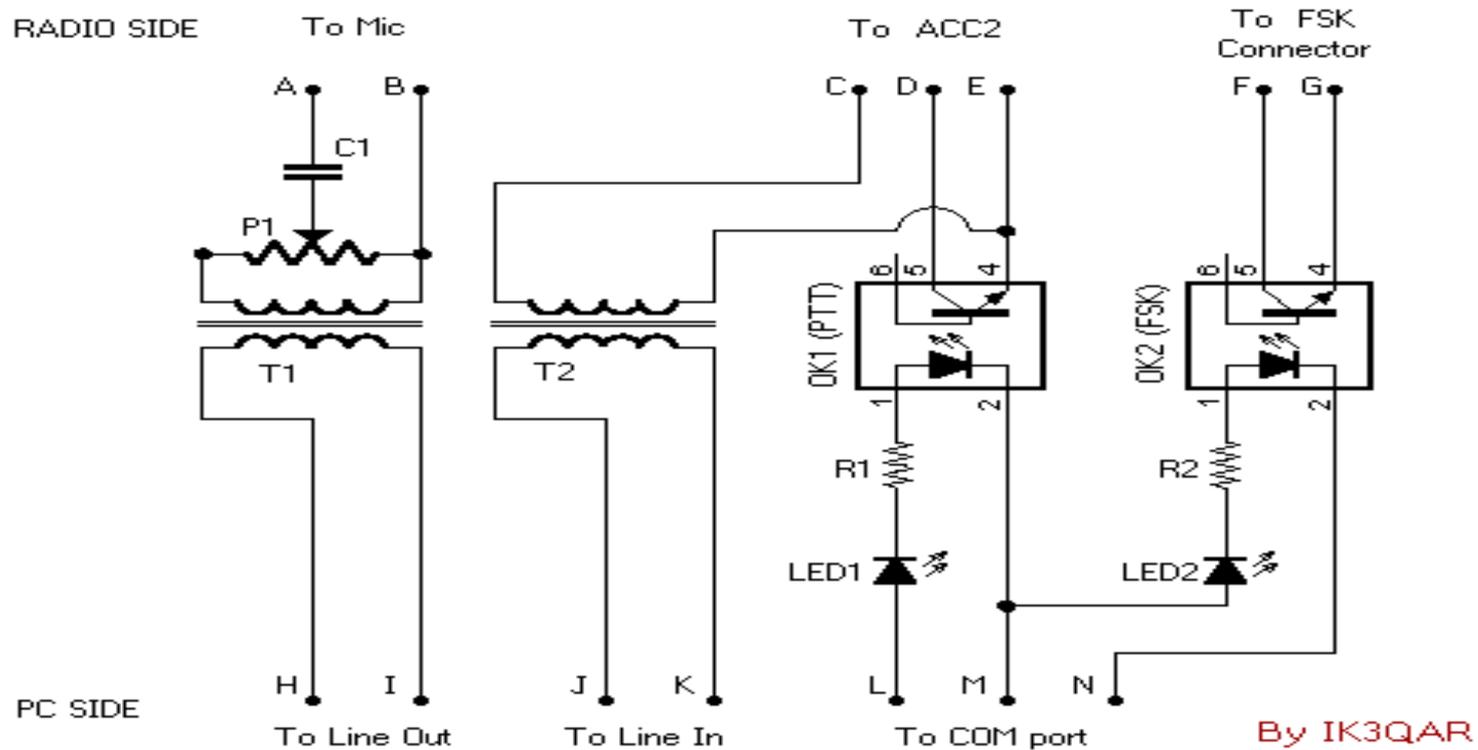
- The RTTY *receive decoder* and *transmit encoder* is sometimes referred to as a MODEM or a TNC:
 - MODEM = Modulator/DEModulator
 - TNC = Terminal Node Controller
- MODEMS can be:
 - built-in to the transceiver
 - a hardware box, or
 - a software application driving a PC soundcard



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AFSK,FSK, PSK & CW Interface



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Serial/RS232 and USB Com Ports

- Many operators install expansion COM Port Boards in their computers. However, another alternative - and the only one for owners of laptops that don't have a standard serial port - is to use a USB-to-Serial port adapter. These devices act like a serial communications port and come in several flavors.
- Not all USB-to-Serial port adapters work the way you would expect a standard serial port to work. Most do not support 5 bit data used for FSK RTTY transmission and most, but not all, will do radio control, CW and PTT.
- I have had good luck with Edgeport serial to USB adapters. You can also check on AA5AU's USB webpage for list of "good" adapters.



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RX/TX Interfaces

Transceiver Based RTTY:

- Icom radios beginning with the 756Pro
- Yaesu newer models
- Elecraft K3 & KX3
- Kenwood TS990

- ❖ Very convenient, no interface or converters required.
- ❖ Also operates PSK
- ❖ Limited in functionality – not a lot of frills.
- ❖ Limited screen area as compared to a flat screen



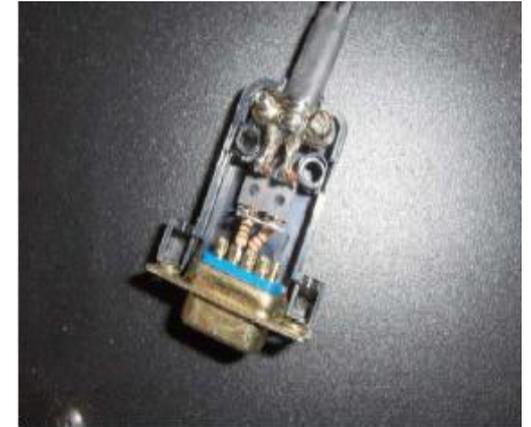
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RX/TX Interfaces

Modem Based RTTY -- Homebrew

- Interface built in to serial D connector shell can be inexpensive way to get on the mode.
- Suggest the use of optocouplers for the keying lines and isolation transformers on the audio in/out line.
- May have to add ferrite chokes to cabling to eliminate RF problems.
- USB interface issue



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RX/TX Interfaces

Commercial

- **Buxcomm** -- Rascal III+ ≈ \$70
(Basic interface)
- **Tigertronics** -- Signalink USB ≈ \$100
(external sound card, USB port interface)
- **Mountain Radio** – RIGblaster line ≈ \$160 to \$300
(USB port interface, sound card choices both ext. & int.)
- **microHam** – USB Interface II, microKEYER II ≈ \$185 to \$500
(USB port interface, ext. sound card, dual RX inputs)



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RX/TX Interfaces

Commercial Advantages

- Most designs take in account Ham RF environment
- Built in USB port interface - timing issues addressed
- Many are external sound card based (with knobs to adjust audio levels)
- A few support 2 receivers

Disadvantages

- Cost
- Another box in the shack



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Digital Operating Practices

- Listen!!
- Make sure you have your transceiver audio levels properly adjusted when using AFSK and PSK
- Split operation? – Verify your transceiver setup before transmitting
- Always be aware of your transmit frequency especially on the 17 and 12 Meter WARC bands
- When announcing a cluster spot, if possible, state the digital mode type in the comment field (i.e. FSK, AFSK.. PSK31)



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Helpful Split Operation Approaches

- Integral 2nd receiver or sub-receiver invaluable for working split
- Setup two decoder windows:
 - Main RX on DX TX freq. -- Sub-RX for tuning pile-up
- Transmit split
- If no sub-RX, then use 'Spot' or 'Rev' or A<>B
- Use of a panadapter or spectrum display very helpful
- Listen!! Does the DX station have a pattern to working the pileup?
- Practice tuning with your eyes closed – learn to tune by ear

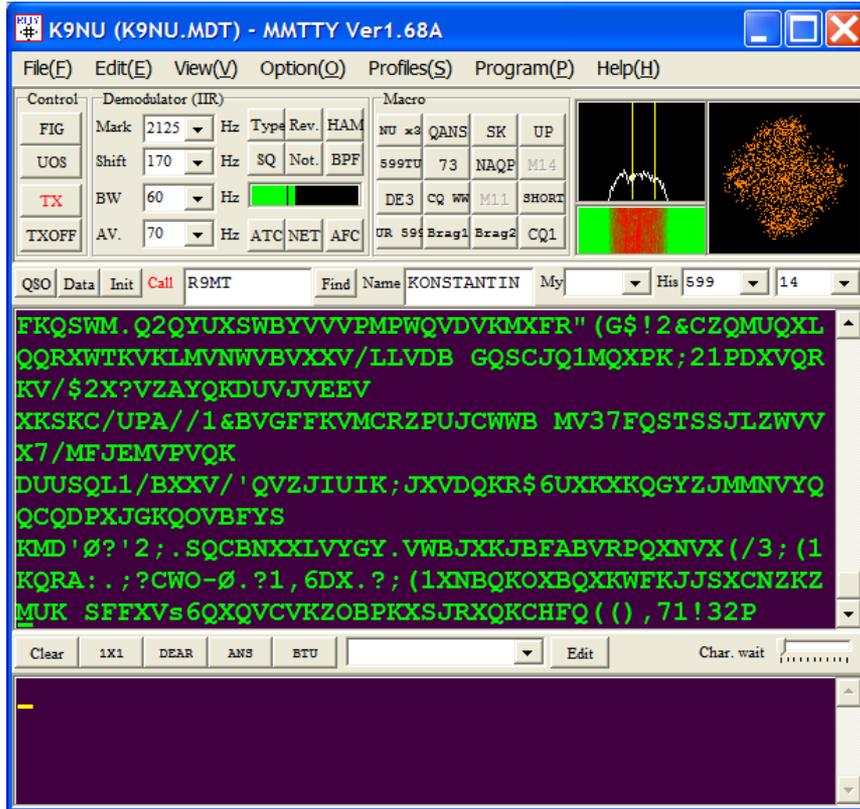


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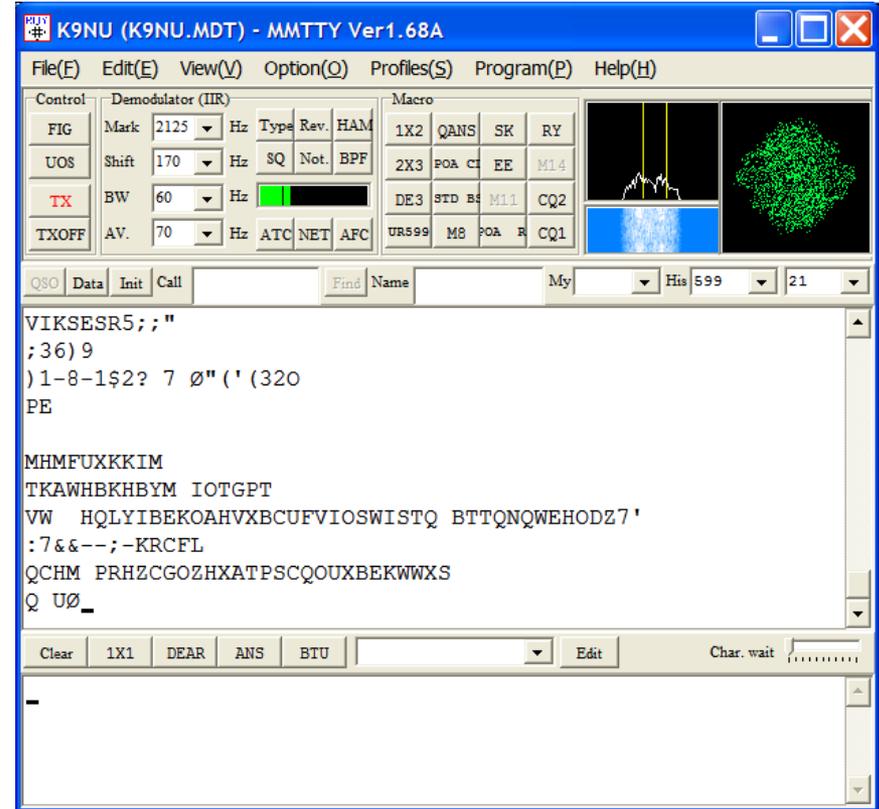


Helpful Split Operation Approaches

Dual Windows



Main RX/TX Window



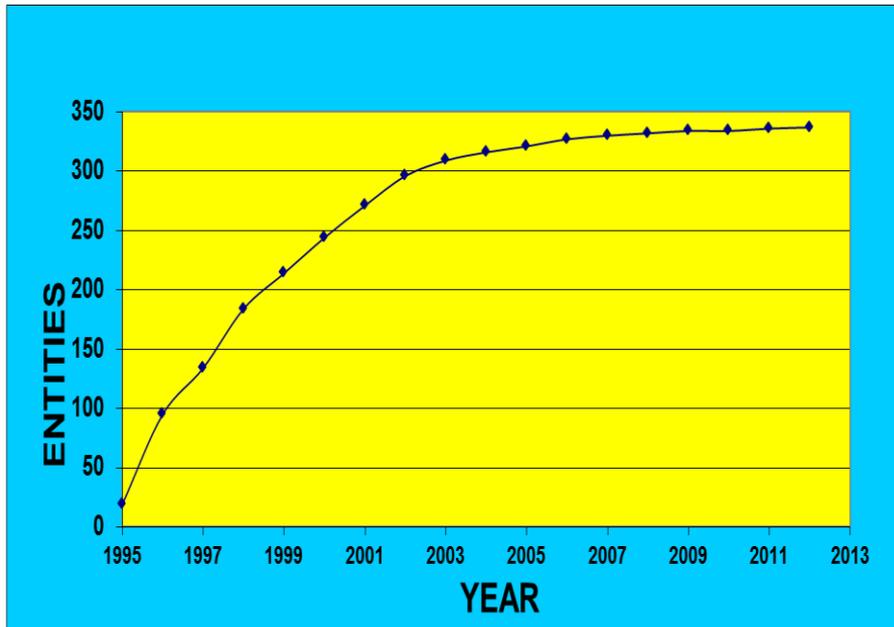
Sub RX Window



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K9NU Digital DXCC History



TOTAL ALL TIME 337 CURRENT 334/340
Need: 3Y/B, BS7, FR/G, FT5W, KP1 & ZS8

Estimated Entity Breakdown

- 45% DXpeditions
- 45% RTTY contests
- 10% other

What Has Helped Me

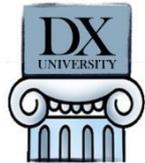
- Doing a lot of listening
- Concentrating on the “money bands”
 - 20 Mtrs. = RTTY-14080 to 14100
 - PSK-14070 to 14072
 - 15 Mtrs. = RTTY-21080 to 21100
 - PSK-21070 to 21072
- Monitoring the DX Cluster
- Using the ARRL QSL Bureau
- Using LoTW



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QUESTIONS?



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